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BETTER HEALTH FOR 5 TO 14 CENTS A YEAR THROUGH FLUORIDATED WATER

Public Health Service
Washington, D. C.

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ENVIRONMENTAL HEALTH CENTER
CINCINNATI, OHIO

BETTER HEALTH

for 5 to 14 cents a year

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BETTER HEALTH FOR 5 TO 14 CENTS A YEAR

Through Fluoridated Water

Prepared by

Division of Dental Public Health

FEDERAL SECURITY AGENCY
Public Health Service
Washington, D. C.

PHS Publication No. 62

February 1951

BETTER HEALTH FOR 5-14 CENTS A YEAR

Healthier children. Sixty-five percent less dental decay. Lower dental bills. These are results that can be obtained by adding fluorides to the community's water supply.

The cost? About the price of a candy bar. Some communities are doing it for 4 cents per person a year. Others run as high as 14 cents.

Most Widespread of All Diseases

Dental decay is perhaps the most widespread of all diseases. Every year it takes an enormous toll in terms of decayed teeth, toothaches, lost teeth, and poor oral health:

> The Nation's children receive only about a third of the fillings they require. Two-thirds of their cavities are neglected.
>
> Sixteen-year olds have an average of 9 decayed teeth and have lost several teeth.
>
> Without adequate preventive or control measures, it is probable that this generation of children will have lost half their teeth before the age of forty.

The fluoridation of water supplies is a powerful aid in improving this situation. It can be done at relatively little cost, is safe and effective when the proper procedures are followed, can be accomplished within the framework of the community's administrative organization, and in addition to improving the health of the community offers substantial economic savings in terms of lower bills for dental services.

More Than 60 Cities Add Fluoride

To reduce dental decay and improve the health of their children, more than sixty communities, most of them in Wisconsin, are adding fluoride to their water supplies.[1]

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[1]See Page 14 for list of communities.

National organizations of professional health workers, impressed by the findings of decades of research on fluorides and dental decay, have endorsed the adding of fluorides to community water supplies.[2] They include:

AMERICAN DENTAL ASSOCIATION

STATE AND TERRITORIAL DENTAL HEALTH DIRECTORS

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

PUBLIC HEALTH SERVICE, FEDERAL SECURITY AGENCY

STATE AND TERRITORIAL HEALTH OFFICERS

AMERICAN PUBLIC HEALTH ASSOCIATION

AMERICAN WATER WORKS ASSOCIATION

Effective While Teeth Are Forming

To gain the full benefits of fluoridated water, children must drink it during the period their teeth are forming, or from birth to about age 8. Older children receive some benefit, but not as much as do children under 8. The protection obtained by children will continue throughout life.

During the first several years of fluoridation, today's children may be brought additional protection by applying a 2 percent solution of sodium fluoride to their teeth at the proper ages. Your State Health Department can assist in establishing a sodium fluoride application program to supplement the adding of fluorides to the community's water supply.

Kinds of Fluoride Compounds Added to Water Supplies

Fluorides are compounds formed by fluorine combining with other elements. These compounds include sodium fluoride, calcium fluoride, potassium fluoride, magnesium fluoride, etc. In other combinations it forms silicofluorides.

Sodium Fluoride is being used in many water fluoridation projects because it is commercially

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[2]See Page 19 for endorsements.

available in large quantities, is convenient to use, dissolves easily, and has been the subject of extensive studies on toxicity and physiological effects.

Sodium silicofluoride (sodium fluosilicate) is one of the most economical compounds. It is plentiful and provides available fluorides at from one-fourth to one-third the cost of fluoride obtained from sodium fluoride.

Hydrofluosilicic acid, while more costly than sodium silicofluoride, can be fed directly into water supplies without considering solubility and with the least handling.

Amount of Fluoride Required Varies

The amount of the fluoride compound required will depend upon the quantity of water to be treated, the fluoride compound used, the present fluoride content of the water, and the desired fluoride concentration.

Normally, one part of fluoride per million parts of water is the concentration maintained in fluoridated water supplies. However, this may be varied on a seasonal and area basis. Your State Health Department should be consulted on the permissible concentration.

In general, a town of 10,000 persons without any fluoride in its water and using one million gallons a day needs to add only 20 pounds of sodium fluoride daily. That much sodium fluoride will maintain the concentration of 1 part of fluoride per million parts of water.[3]

If sodium silicofluoride is used instead of sodium fluoride, 14 pounds should be added to each million gallons of water to maintain a concentration of one part of fluoride per million parts of water.

A very small amount of the fluoride compound is needed by each child to effect a reduction in dental decay of some 65 percent. If the child drinks an average of a quart of water a day from birth to 7½ years of age, he would consume 1 tablespoonful of fluoride for the entire period, or less than a third of a teaspoonful

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[3]See Page 16 for cost of compounds.

annually. Consumption from birth to age 60 is about 8 tablespoons of sodium fluoride, or 6 of sodium silicofluoride.

Little Water Used for Drinking

The people of a community drink only a very small fraction of the water distributed. The rest is used for industrial, sanitary, and other purposes. Despite this loss of most of the fluoride, the annual cost per person for fluoridating water supplies is between 5 and 14 cents, depending largely upon the kind of fluoride compound used and the per capita water consumption.

It has been suggested that fluoride compounds be added to milk and other foods, that food be grown on soil rich in fluoride, that cows be fed fluoride enriched feeds, and that drinking water be fluoridated in the home. In the light of present knowledge, such schemes are impractical when compared with the simplicity and low cost of fluoridating the public water supply.

Solution Feeders Used in Small Towns

The mechanical feeders used in adding fluoride to water supplies have generally been the same type of machines used for feeding lime, alum, and other chemicals in water treatment and industrial plants. They have been used for many years, do the job accurately, and are easily regulated to control the amount of fluoride added to a given quantity of water. Such feeders are of two general types: solution feeders and dry feeders.

Solution feeders are essentially small accurate pumps that deliver a measured quantity of prepared solution during a specified time. The concentration of the solution and the controls on the feeder can be adjusted to meet the needs of a particular community.

Where sodium fluoride is used, the strength of the solution fed into the water supply is usually 3 to 3.5 percent, or a stronger, saturated solution can be made with a recently developed saturator. A much weaker solution can be made for use in very small communities.

Solution feeders can be used for feeding sodium fluoride and sodium silicofluoride in communities of up to about 20,000 population, or in communities requiring as much as 2 million gallons of water daily.

Hydrofluosilicic acid can be fed by solution feeders in towns of any size, from the smallest community to the largest cities.

The cost of solution feeders varies between $325 and $1500 depending on capacities, installation charges, and auxiliary equipment. They may be obtained from a variety of sources.[4]

Bigger Communities Use Dry Feeders

In general, it is more economical and convenient to use dry feeders when the daily consumption of water exceeds two million gallons. These feeders are of two types: volumetric and gravimetric.

Volumetric Feeders: In the volumetric feeder a slowly turning disc, belt, or roller delivers a measured volume of the solid fluoride compound per minute. Such feeders are being used in adding sodium fluoride at plants delivering from 2 to 5 million gallons of water daily, or for towns of between 20,000 and 50,000 population. They may also be used for feeding sodium fluoride and sodium silicofluoride in towns of from 2,000 to more than 120,000 persons requiring from 200,000 to 12,000,000 or more gallons of water daily.

Volumetric feeders cost between $600 and $3,500 without installation charges and auxiliary equipment.[4]

Gravimetric Feeders: Another type of dry feeder, the gravimetric feeder (loss-in-weight type), has been used for the larger water supplies. It feeds a predetermined weight of the fluoride compound within a specified time. It can feed up to 5,000 pounds per hour, an amount far in excess of the needs of the largest city in the United States. It is also capable of feeding as little as 10 pounds per hour, enough to treat 12 million gallons of water daily with sodium fluoride or silicofluoride. Cities using 12 million gallons daily usually have a population of about 120,000.

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[4]See Page 18 for list of manufacturers.

Gravimetric feeders cost $2,000 or more, depending upon size and accessories.[4]

Feeders Equipped With Automatic Controls

Solution and dry feeders are generally connected electrically with pump motors to stop the feeder automatically when the pump stops. Manual adjustment of the rate of feed is easily made on all feeders when changes in the amounts of water to be treated can be anticipated. If these changes are not predictable, feeding rates can be varied automatically.

The mechanics of feeding fluorides - except hydrofluoric acid, which is dangerous to handle, corrosive, and not recommended - are no more involved than the feeding of chemicals ordinarily used in water purification.

Communities can obtain assistance from their State Health Department in selecting the proper fluoride compound to be used, the type of feeder required, and the point at which the fluoride should be added.

Where To Add Fluorides

The point in the water system where the fluoride is added must be determined separately for each community. Fluoride can be introduced into a reservoir, into the well directly, or into the discharge or suction side of a pump. Feeders are available for discharging solutions against any head encountered in water supply practice.

Sometimes the location of the application point involves a compromise between what is considered the best point in the system for adding fluorides and the best place to replenish the feeder hopper. But, in general, fluorides are applied most effectively at that point where the risk of losing them in subsequent treatment is least.

Fluoride Safe for Use in Water Supplies

Throughout their entire lives hundreds of thousands of people have been drinking water containing

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[4]See Page 18 for list of manufacturers.

several times as much fluoride as is recommended for fluoridation. As far as can be determined, they have suffered no ill effects except for dental fluorosis, a staining of the teeth.

At the concentrations recommended for fluoridating community water supplies, there is no discoloration of the teeth. In fact, people who have consumed water containing the recommended amount of fluoride have unusually attractive teeth.

Chlorination does not interfere with the beneficial effects of fluoridation. Fluoridated water may be drunk immediately after the fluoride compound has been added. There is no need to wait for the fluorine to take effect, as there is with chlorine.

Fluoride does not add taste, color, odor, or hardness to water. Home water softening units do not remove the added fluorides. Even at higher concentrations, the use of fluoride bearing water has had no known effects in industrial processes.

In water plants, continuous exposure to fluoride dust may prove injurious, and certain precautions should be taken to protect the operators, such as the installation of dust exhaust systems, the wearing of rubber gloves, and the use of masks equipped with dust filters. Hands should be washed after each filling of the hopper.

Simple Tests Used

Simple tests have been developed for determining the fluoride content of water supplies. These tests are made several times a day, and when once "set up" can be conducted by water works personnel. In addition to making their own daily tests, the local water works office sends samples at regular intervals to the State Health Department for checking.

Generally, water departments use a colorimetric test to determine the fluoride content of water where the accuracy desired is within 0.20 parts of fluoride per million parts of water and where interference from other substances is negligible. In this test a color indicator is added to samples obtained from various points in the distribution system and plant. The color of the sample is then matched with the color of standards containing known amounts of fluoride.

Returns From 5 Cents a Year

The total daily cost of adding sodium fluoride to the water supply of an average town of 10,000 is about $2.25. If sodium silicofluoride is used, the total daily cost is about 75 cents. On a per person basis, sodium fluoride costs about 11 cents a year, silicofluoride, about 5 cents. Amortized over a 20-year period, the annual cost of equipment for feeding fluoride into the water supply is almost negligible.

For an annual investment per person of about the price of a candy bar, the community can bring greatly improved dental health to its younger children. As fluoridation is continued, more and more children will be protected, until eventually all who have drunk the water from birth will be benefited.

Measured in terms of improved health, the benefits are great -- two-thirds less tooth decay; better, more attractive teeth; and a reduction in illnesses due to maladies caused by dental abscesses and infections.

In addition, there are economic savings. With the reduction in dental decay, the bills for restoring decayed teeth with fillings will be reduced by two-thirds. There will be fewer extractions and, as the children grow older, the need for replacement will be reduced.

Initiating a Fluoridation Program

In many communities, local dental and medical societies have taken the initiative in stimulating the interest of the public and the proper authorities in fluoridation.

In other communities, the initiative has been taken by the lay public through civic clubs, women's groups, and fraternal organizations, working in cooperation with local dental and medical societies, health departments, and water departments.

With the support of medical and dental societies, health departments, and the general public, the local councils have then authorized the water department to add fluoride to community water supplies. Always the assistance and approval of the State Health Department have been and should be obtained.

Funds for fluoridation projects have come from the community's general fund, or from the community's health department or water department appropriations, but in most communities the local health departments finance the program.

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BRIEFLY

Adding fluoride to the community's water supply will reduce dental decay in children about 65 percent--improve the appearance of their teeth.

Annual cost of fluoridating the water supply is about 4 or 5 cents per person in the community if sodium silicofluoride is used.

Fluoride does not add taste, color, odor, or hardness to water.

For many years fluoride bearing water has been used without ill effects in a great variety of industrial plants.

Fluoridating the community's water supply will sharply reduce the dental bills of the younger generation.

Older children not receiving the full benefits of fluoridation can be protected by applications of sodium fluoride to their teeth.

To delay fluoridating the water supply deprives children of substantial health benefits that can be obtained at very little cost.

PART II

Some Cities Fluoridating Their Water Supplies

Fluoride Compound Costs

Approximate Capacities of Feeders

Sources of Fluoride Feeders

Endorsements of Fluoridation

SOME OF THE CITIES IN THE UNITED STATES THAT ARE FLUORIDATING THEIR WATER SUPPLIES (February 1951)

City and State	Date Started	Population 1950
Crossett, Arkansas		4,614
New Britain, Connecticut		73,663
Salisbury, Connecticut		3,076
Southbury State School, Conn.	4/45	3,799
Newark, Delaware	'50	6,701
Gainesville, Florida	'50	26,577
Mount Dora, Florida	1/51	3,039
Lewiston, Idaho	6/47	12,910
Evanston, Illinois	2/47	73,030
Ottawa, Kansas	9/46	10,051
Belchertown State School, Mass.	'46	3,486
Wrentham State School, Mass.	'46	5,357
Algonac, Michigan	9/49	2,607
Grand Rapids, Michigan	1/45	175,647
Hastings, Michigan		6,060
Ludington, Michigan	12/49	9,066
Midland, Michigan	1/46	14,202
Morristown, New Jersey	'50	17,078
Newburgh, New York	5/45	31,924
Charlotte, North Carolina	4/49	133,212
Ninety Six, South Carolina		1,558
Fort Mill, South Carolina		3,205
Aberdeen, South Dakota	12/50	20,976
Corpus Christi, Texas	3/50	108,053
Iowa Park, Texas		2,115
Marshall, Texas	5/46	22,255
Kennewick, Washington		10,086
Wheeling, West Virginia	9/50	58,447
Weirton, West Virginia		24,193
Antigo, Wisconsin	6/49	9,897
Appleton, Wisconsin		33,892
Ashland, Wisconsin	10/49	10,589
Baraboo, Wisconsin	5/49	7,217
Beloit, Wisconsin	4/49	29,541
Bloomer, Wisconsin	8/50	2,557
Columbus, Wisconsin	8/50	3,230
Eau Claire, Wisconsin		35,862
Edgar, Wisconsin	11/49	707
Elkhorn, Wisconsin	4/48	2,917

Cities Fluoridating (Continued)

City and State	Date Started	Population 1950
Evansville, Wisconsin	3/50	2,530
Edgerton, Wisconsin		3,495
Fond du Lac, Wisconsin	7/50	29,918
Fort Atkinson, Wisconsin	12/49	6,257
Hartford, Wisconsin	1/50	4,545
Janesville, Wisconsin	2/49	24,829
Madison, Wisconsin	6/48	95,534
Marshfield, Wisconsin	9/50	12,377
Mayville, Wisconsin	9/50	2,995
Mazomanie, Wisconsin		963
Menasha, Wisconsin	8/50	12,360
Middleton, Wisconsin	6/50	2,101
Mukwonago, Wisconsin	5/49	1,203
Neenah, Wisconsin	3/50	12,361
Neopit, Wisconsin		1,257
Oregon, Wisconsin	2/50	1,323
Oshkosh, Wisconsin	1/50	40,872
Phillips, Wisconsin		1,790
Port Washington, Wisconsin	9/50	4,754
Racine, Wisconsin	3/50	70,749
Reedsburg, Wisconsin	2/50	4,078
Rhinelander, Wisconsin	5/50	8,720
Richland Center, Wisconsin	12/49	4,614
Sheboygan, Wisconsin	2/46	42,485
Soldiers Grove, Wisconsin	1/50	
Stevens Point, Wisconsin	'50	16,550
Stoughton, Wisconsin	9/49	4,813
Sun Prairie, Wisconsin	3/50	2,262
Waupun, Wisconsin		6,725
Watertown, Wisconsin		12,393
West Bend, Wisconsin	8/50	6,844
Westby, Wisconsin		1,490
Wisconsin Rapids, Wisconsin		13,518
Sheridan, Wyoming		11,402

FLUORIDE COMPOUND COSTS[1]

(January 1951)

Fluoride Compound	Cost Cents/lb.	To treat 1 mil. gals. of water (1.0 part per million)		Cost per person per year in cents[2]
		Pounds	Cost	
Sodium Fluoride (90%)	10.5	20.5	$2.15	7.8
Sodium Fluoride (98%)	11.5	18.8	2.15	7.8
Sodium Silicofluoride (98%)	5.0	13.9	.70	2.5
Hydrofluosilicic Acid (23%)	2.5	46.5	1.16	4.2
Hydrofluosilicic Acid (23%) (Barrels)	5.0	46.5	2.32	8.4

[1]Carload Prices, FOB Manufacturer. Prices in smaller quantities may be as much as 100% higher.

[2]Based on 100 gals. per person daily.

APPROXIMATE CAPACITIES OF FEEDERS

Fluoride Compounds	Solution Feeders ($325 - $1500)[1]		DRY FEEDERS			
			Volumetric ($375 - $2000)[1]		Gravimetric ($2000 - $5000)[1]	
	Gallons Daily[2]	Pop.[3]	Gallons Daily[2]	Pop.[3]	Gallons Daily[2]	Pop.[3]
Sodium Fluoride	Up to 2,000,000	Up to 20,000	200,000 to 12,000,000 or more	2,000 to 120,000 or more	12,000,000 or more	120,000 or more
Sodium Silico-fluoride	Up to 2,000,000	Up to 20,000	200,000 to 12,000,000 or more	2,000 to 120,000 or more	17,000,000 or more	170,000 or more
Hydrofluo-silicic Acid	Unlimited	Unlimited	Not Used	Not Used	Not Used	Not Used

[1]Depends on capacity and accessory cost.

[2]Gallons daily at 1 p.p.m. of fluoride.

[3]Based on daily consumption of 100 gallons per person -- will vary with industrial uses and climate.

SOME MANUFACTURERS OF FEEDERS

Solution Feeders

Graver Water Conditioning Company
New York 11, New York

Hills-McCanna Company
Chicago 18, Illinois

Infilco, Inc.
Tucson, Arizona

Lapp Insulator Company
Leroy, New York

Milton Roy Company
Philadelphia 6, Pennsylvania

Morse, Boulger Destructor Company
New York 17, New York

Omega Machine Company
Providence 1, Rhode Island

Permutit Company, Inc.
New York 18, New York

Proportioneers, Inc.
Providence 1, Rhode Island

T. Shriver and Co., Inc.
Harrison, New Jersey

Wallace and Tiernan, Inc.
Newark 1, New Jersey

DRY FEEDERS

Volumetric Feeders

B. F. Gump Company
Chicago 50, Illinois

Infilco, Inc.
Tucson, Arizona

Jeffrey Manufacturing Company
Columbus 16, Ohio

Omega Machine Company
Providence 1, Rhode Island

Permutit Company, Inc.
New York 18, New York

Wallace and Tierna nc.
Newark 1, New Jers

Syntron Company
Homer City, Pennsylvania

Gravimetric Feeders

Jeffrey Manufacturing Company
Columbus 16, Ohio

Omega Machine Company
Providence 1, Rhode Island

Wallace and Tiernan, Inc.
Newark 1, New Jersey

ENDORSEMENTS OF THE FLUORIDATION OF PUBLIC WATER SUPPLIES

American Dental Association
October 30 - November 2, 1950
Annual Meeting, Atlantic City, N. J.

WHEREAS, numerous studies have demonstrated a decreased incidence of dental decay associated with the presence of fluoride occurring naturally in drinking water, and

WHEREAS, there is a rapidly accumulating body of data derived from direct studies of the artificial addition of fluoride to drinking water, and

WHEREAS, these data provide convincing evidence of the safety of this procedure and of its benefits in terms of reduced incidence of dental caries, therefore be it

RESOLVED, that in the interest of public health, the American Dental Association recommends the fluoridation of municipal water supplies when the fluoridation procedure is approved by the local dental society and utilized in accordance with the standards established by the responsible health authority, and be it further

RESOLVED, that the American Dental Association recommends the continuation of controlled studies of the benefits derived from the fluoridation of water supplies.

* * *

State and Territorial Dental Health Directors
June 8, 1950
Washington, D. C.

RESOLVED, that the State and Territorial Dental Health Directors recommend the fluoridation of public water supplies for the partial control of dental caries, where the local dental and medical professions have approved this program and where the community can meet and maintain the standards required by the State Health Authority.

* * *

American Water Works Association
June 1, 1949
Annual Conference, Chicago, Illinois

In communities where a strong public demand has developed and the procedure has the full approval of the local medical and dental societies, the local and State health authorities, and others responsible for the communal health, the water departments or companies may properly participate in a program of fluoridation of the public water supplies.

* * *

American Association of Public Health Dentists
October 29, 1950
Annual Meeting, Atlantic City, N. J.

RESOLVED, that the American Association of Public Health Dentists recommend and encourage the fluoridation of public water supplies for the partial control of dental caries where the community can meet and maintain the standards required by the State Health Authority.

* * *

Public Health Service, Federal Security Agency
June 22, 1950
Washington, D. C.

Preliminary data suggest a lowered amount of dental decay following fluoridation of the public water supply. Although evidence is rapidly accumulating, the controlled studies now being carried on should be continued and others as may be necessary inaugurated.

In order to utilize this preventive at the earliest possible moment, formulation of plans for fluoridation of public water supplies as a procedure for the partial control of dental caries may be encouraged subject to the approval of the State and local health authorities and the dental and medical professions.

* * *

State and Territorial Health Officers
November 1950
Annual Meeting, Washington, D. C.

WHEREAS, careful scientific observations since 1929 indicate that tooth decay is not as prevalent in individuals using water supplies containing sodium fluoride, and

WHEREAS, the artificial fluoridation of public water supplies was experimentally instituted and has been under continuous study since 1945, and

WHEREAS, these studies have shown that there is no menace to the teeth of the persons using one part per million of sodium fluoride, and

WHEREAS, State and Territorial Dental Health Directors have endorsed in principle the fluoridation of public water supplies as a partial protection against dental caries, therefore be it

RESOLVED, that the Association of State and Territorial Health Officers recommend, where the medical and dental professions concur and where communities can meet the standards of the State Health Authorities that all State health officials approve the artificial fluoridation of public water supplies for the partial control of dental caries.

* * *

American Public Health Association
November 1950
Annual Meeting, St. Louis, Missouri

WHEREAS, accumulated evidence indicates a sound basis for the fluoridation of public water supplies for the partial control of dental caries, therefore, be it

RESOLVED, that this procedure be recommended as a safe and effective method for reducing the prevalence of dental caries.

* * *

GPO 83-171635